* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] In the micro power converter with which the passive component of a thin film was formed through the 1st insulator layer on the semiconductor integrated circuit equipment formed in the semiconductor substrate On said semiconductor integrated circuit equipment, the flat-surface mold magnetic-induction component of a configuration of having inserted the thin film coil with the lower magnetic substance and the up magnetic substance is formed. The power converter characterized by forming said lower magnetic substance formed in said semiconductor integrated circuit equipment side of this flat-surface mold magnetic-induction component with a magnetic-substance thin film, and forming said up magnetic substance of said flat-surface mold magnetic-induction component with magnetic-substance sheet metal.
[Claim 2] The power converter according to claim 1 characterized by forming a thin film capacitor on said magnetic-substance sheet metal.
[Claim 3] The power converter according to claim 1 or 2 characterized by the thin film coil of said flat-surface mold magnetic-induction component having connected with said semiconductor integrated circuit equipment electrically through the contact hole which was able to be opened in said 1st insulator layer formed between said semiconductor integrated circuit equipment and said magnetic-substance thin films.
[Claim 4] The power converter according to claim 1 or 2 with which said magnetic-substance sheet metal is characterized by being formed with a ferrite magnetism plate.
[Claim 5] The conductor which forms the aforementioned thin film coil is a power converter according to claim 1 to 4 characterized by being covered by the insulator.
[Claim 6] the conductor with which said insulator forms the 3rd insulator layer formed between said lower magnetic substance, the 2nd insulator layer by which it was formed between said thin film coils and said up magnetic substance, and a thin film coil, and said thin film coil -- the power converter according to claim 5 characterized by consisting of the 4th insulator layer with which the clearance between between was filled up.
[Claim 7] The power converter according to claim 6 with which said 4th insulator layer is characterized by being formed with polyimide.
[Claim 8] the conductor which forms said thin film coil -- the power converter according to claim 5 characterized by having a clearance in between.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to power converters, such as a DC-DC converter which consists of thin film passive components formed on the semiconductor integrated circuit equipment formed in the semi-conductor substrate, and this semiconductor integrated circuit equipment, such as a thin film coil and a thin film capacitor.
[0002]
[Description of the Prior Art] As for DC power supplies, such as a DC-DC converter used for a pocket device etc., small, a light weight, and power saving are called for. In recent years, the point of the hybrid mold power source module which development is activating of a miniaturization is applied to how magnetic-induction components which are passive components carried in a semi-conductor substrate, such as a coil and a transformer, are miniaturized. This miniaturization technology shows the remarkable advance with techniques, such as MCM (multi chip module).
[0003] In recent years, semiconductor technology is applied, the example which carried the flat-surface mold magnetic-induction component (a coil, transformer) which is a thin micro magnetic-induction component on the semi-conductor substrate is reported, and it is indicated by Japanese Patent Application No. No. 149626 [eight to] etc. about the structure of this flat-surface mold magnetic-induction component etc.
[0004]
[Problem(s) to be Solved by the Invention] the conductor which the thin magnetic-substance thin film 54 is formed on the thin film coil 56, and forms this thin film coil 56 as the structure of the flat-surface mold magnetic-induction component carried in the conventional small power converter is shown in drawing 4 -- the clearance between between is filled up with the insulating filler (polyimide filler 55). Moreover, for a silicon substrate and 52, as for a lower insulator layer and 57, IC protective coat and 53 are [51 / an up insulator layer, the flat-surface mold magnetic-induction component of the former / 58 / 61 / a magnetic-substance thin film and /, and 62] protective coats by the number in drawing.
[0005] In this structure, by heat treatment, the magnetic-substance thin films 54 and 58 and the polyimide filler 55 will contract, and a semi-conductor substrate will curve for that stress. This curvature is produced by contraction of the magnetic-substance thin films 54 and 58 and the polyimide filler 55, that tensile stress is as large as 58xN/cm, and about 1200-micrometer curvature produces it in the silicon substrate 51 with a diameter [of 6 inches], and a thickness of 625 micrometers. Thus, if big curvature arises, processing of the photolithography of the up insulator layer 57 formed after that, the magnetic-substance thin film 58, and a protective coat 62 etc. will become difficult.
[0006] Moreover, although the magnetic-substance thin films 54 and 58 are formed by the spatter, since magnetic flux tends to be saturated since only about 10 micrometers can grow even if a growth rate is slow and thick, flux density is large and the engine performance of a flat-surface mold magnetic-induction component cannot take bad, it is necessary to enlarge occupancy area of the thin film coil 56. Furthermore, since a capacitor required as a small power converter is put side by side with the thin film

coil 56 or a silicon substrate 51, a small power converter becomes large. The purpose of this invention solves the aforementioned technical problem, is micro, is highly efficient, and is to offer the power converter which curvature does not produce in a semi-conductor substrate.
[0007]
[Means for Solving the Problem] In the micro power converter with which the passive component of a thin film was formed through the 1st insulator layer on the semiconductor integrated circuit equipment formed in the semi-conductor substrate in order to attain the aforementioned purpose On said semiconductor integrated circuit equipment, the flat-surface mold magnetic-induction component of a configuration of having inserted the thin film coil with the lower magnetic substance and the up magnetic substance is formed. Said lower magnetic substance formed in said semiconductor integrated circuit equipment side of this flat-surface mold magnetic-induction component is formed with a magnetic-substance thin film, and said up magnetic substance of said flat-surface mold magnetic-induction component considers as the configuration formed with magnetic-substance sheet metal.
[0008] When a thin film capacitor is formed on said magnetic-substance sheet metal, it is good because of a miniaturization. It can miniaturize, if the thin film coil of said flat-surface mold magnetic-induction component connects with said semiconductor integrated circuit equipment electrically through the contact hole which was able to be opened in said 1st insulator layer formed between said semiconductor integrated circuit equipment and said magnetic-substance thin films. If said magnetic-substance sheet metal is formed with a ferrite magnetism plate, the flux density in a FIRAITO magnetism plate will increase, the property of a flat-surface mold magnetic-induction component improves, the engine performance of a power converter improves, and there is effectiveness also in a miniaturization. Moreover, since curvature does not occur, processing becomes easy.
[0009] The conductor which forms the aforementioned thin film coil is good to be covered by the insulator. the conductor with which said insulator forms the 3rd insulator layer formed between said lower magnetic substance, the 2nd insulator layer by which it was formed between said thin film coils and said up magnetic substance, and a thin film coil, and said thin film coil -- if it consists of the 4th insulator layer with which the clearance between between was filled up, insulation will improve. This 4th insulator layer of being formed with polyimide is good. the conductor which forms said thin film coil -- if it has a clearance in between, it will much more be hard coming to generate the curvature of a semi-conductor substrate
[0010]
[Embodiment of the Invention] Drawing 1 is the micro power converter of the 1st example of this invention, this drawing (a) is an important section sectional view, and this drawing (b) is an explanatory view of the A section of this drawing (a). It is the polyimide film and SiO2 on the silicon substrate 1 which formed the DC-DC converter which accumulated IC for control, and the switching element as semiconductor integrated circuit equipment as shown in this drawing (b). The flat-surface mold magnetism induction component 11 is formed on the IC protective coats 2, such as film. IC for control which constitutes this DC-DC converter is formed by the CMOS circuit, and a switching element is for example, high proof-pressure p channel MOS FET for switching, and this drain is connected to a bonding pad 9. This flat-surface mold magnetism induction component 11 forms the magnetic-substance thin film 4 in one field of the thin film coil 6 through the lower insulator layers 3, such as polyimide film, (this magnetic-substance thin film 4 is surrounded by the lower insulator layer 3), and is having structure which fixed the ferrite magnetism plate 8 which is magnetic-substance sheet metal through the up insulator layer 7 to the field of another side. The lower insulator layer 3 of the flat-surface mold magnetic-induction component 11 is formed on the IC protective coat 2 formed on the silicon substrate 1. In addition, the lower insulator layer 3 and the IC protective coat 2 of the flat-surface mold magnetic-induction component 11 which were manufactured according to the individual may be fixed. Moreover, the up insulator layer 7 and magnetic-substance sheet metal 8 fix after alignment by epoxy adhesion resin. the conductor of the thin film coil 6 -- in between, it fills up with the polyimide filler 5. The both ends of the thin film coil 6 open a contact hole 12 in the IC protective coat 2 and the lower insulator layer 3, and connect it with a silicon substrate 1 through this contact hole 12.

[0011] Thus, when the flux density in the ferrite magnetism plate 8 increases, the property of the flat-surface mold magnetic-induction component 11 improves by using the up insulator layer 7 and the magnetic substance which fixes as the ferrite magnetism plate 8 thicker than the conventional magnetic-substance thin film 58 and a DC-DC converter is manufactured now, the maximum conversion efficiency improves. Moreover, the miniaturization of the flat-surface mold magnetic-induction component 11 can be attained because flux density increases. Moreover, since it is hard coming to generate curvature in a silicon substrate 1, subsequent processing becomes easy. When the ferrite magnetism plate 8 of 300-micrometer thickness was used, specifically, curvature was mitigated about [conventional] to 2/3. Moreover, in order to fix the ferrite magnetism plate 8 by epoxy adhesion resin, a process is simplified rather than the case where the conventional magnetic-substance thin film 58 is formed by the spatter (reduction of a man day etc.). Moreover, by fixing the thin film coil 6 to the direct silicon substrate 1, it can miniaturize and, of course, dependability improves. Moreover, if the thickness of the ferrite magnetism plate 8 is 100 micrometers or more, the effectiveness of this invention will be acquired.

[0012] In addition, this drawing (b) shows a part of control circuit IC and the high proof pressure MOSFET for a switch which form a DC-DC converter. A control circuit IC shows n channel MOS FET and p channel MOS FET which constitute a complementary symmetry circuit, and n channel MOS FET is carrying out the duty with which p channel MOS FET slushes a current into the thin film coil 6, and the high proof pressure MOSFET for a switch draws out a current from the thin film coil 6. Moreover, the drain of the bonding pad 9 which the thin film coil 6 connects, p channel MOS FET, and n channel MOS FET is connected with the aluminum wiring 33. Moreover, the oxide film with which 31 in drawing consists of three layers, and 32 are the gate electrodes of MOSFET.

[0013] Drawing 2 is the important section sectional view of the micro power converter of the 2nd example of this invention. The difference from drawing 1 is the point of having lost the polyimide filler 5 filled up with the clearance between the conductors which form the thin film coil 6, and having covered the front face of the thin film coil 6 with the protective coats 13, such as an oxide film with a thickness of about 1 micrometer. This protective coat 13 is equivalent to the up insulator layer 7 of drawing 1 . The method of losing the polyimide filler 5 is good by skipping the process filled up with the polyimide filler after forming the thin film coil 6. Moreover, the oxide film which is this protective coat 13 may also form PVD, such as sputtering, by whichever of a CVD method. In addition, the part where the polyimide filler 5 exists by drawing 1 serves as a cavity, and this cavity is filled with air 14 etc.

[0014] Thus, since there is no polyimide filler 5, compared with the case of drawing 1 , it is much more hard coming to generate the curvature of a silicon substrate 1. Specifically, curvature was reduced about [conventional] to 1/5. Therefore, processing by the photolithography of the protective coat 13 after forming the thin film coil 6, the alignment at the time of attachment of the ferrite magnetism plate 8, etc. become easy. Other effectiveness is the same as the case of drawing 1 .

[0015] In addition, although not illustrated to the silicon substrate 1 of drawing 2 , of course to it, the DC-DC converter of drawing 1 (b) is formed. Drawing 3 is the important section sectional view of the micro power converter of the 2nd example of this invention. The difference from drawing 2 fixes what formed the thin film capacitor 20 through the insulator layer 17 on the ferrite magnetism plate 8 on an insulator layer 13. the electrode 16 of this thin film capacitor 20 -- Pt -- it is -- the ferroelectric thin film 15 -- PbZr1-x Tix O3 Or Pb(ScTa) O3 etc. -- it is formed with a ferroelectric ingredient. A thin film capacitor 20 is connected with a silicon substrate 1 by the wire bonding 10. In addition, of course, what formed the thin film capacitor 20 of drawing 3 in ferrite magnetism plate top 8 of drawing 1 through the insulator layer is not cared about, even if it fixes with the up insulator layer 7. If it is 100 micrometers or more as thickness of the ferrite magnetism plate 8, the effectiveness of this invention will be acquired.

[0016] Although the area of a small power converter was large in drawing 1 and drawing 2 since a capacitor was put side by side with a silicon substrate 1 on a silicon substrate 1 on the flat-surface mold magnetic-induction component 11, juxtaposition, or the circuit board The area of a silicon substrate 1 becomes small by carrying out a laminating on the flat-surface mold magnetic-induction component 11.

Thus, in small power converters, such as a DC-DC converter The thin film capacitor 20 for smooth can be extended on 2 thru/or three pieces, and a silicon substrate 1, and the component-side products of a power converter can be reduced about [conventional] to 2/3.
[0017] In addition, although not illustrated to the silicon substrate 1 of drawing 3 , of course to it, the DC-DC converter of drawing 1 (b) is formed.
[0018]
[Effect of the Invention] According to this invention, the curvature of a semi-conductor substrate becomes small by using as magnetic-substance sheet metal like a ferrite magnetism plate thicker than the conventional magnetic-substance thin film the magnetic substance formed on a thin film coil. Processing of a subsequent process becomes easy because curvature becomes small. Moreover, flux density goes up by making it a ferrite magnetism plate with thickness thicker than the conventional magnetic-substance thin film, and the property of a flat-surface mold magnetic-induction component improves by it. Moreover, a miniaturization can be attained by fixing a thin film coil directly to a semi-conductor substrate. Furthermore, much more miniaturization can be attained by carrying out the laminating of the thin film capacitor on a flat-surface mold magnetic-induction component.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to power converters, such as a DC-DC converter which consists of thin film passive components formed on the semiconductor integrated circuit equipment formed in the semi-conductor substrate, and this semiconductor integrated circuit equipment, such as a thin film coil and a thin film capacitor.

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PRIOR ART

[Description of the Prior Art] As for DC power supplies, such as a DC-DC converter used for a pocket device etc., small, a light weight, and power saving are called for. In recent years, the point of the hybrid mold power source module which development is activating of a miniaturization is applied to how magnetic-induction components which are passive components carried in a semi-conductor substrate, such as a coil and a transformer, are miniaturized. This miniaturization technology shows the remarkable advance with techniques, such as MCM (multi chip module).
[0003] In recent years, semiconductor technology is applied, the example which carried the flat-surface mold magnetic-induction component (a coil, transformer) which is a thin micro magnetic-induction component on the semi-conductor substrate is reported, and it is indicated by Japanese Patent Application No. No. 149626 [eight to] etc. about the structure of this flat-surface mold magnetic-induction component etc.

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EFFECT OF THE INVENTION

[Effect of the Invention] According to this invention, the curvature of a semi-conductor substrate becomes small by using as magnetic-substance sheet metal like a ferrite magnetism plate thicker than the conventional magnetic-substance thin film the magnetic substance formed on a thin film coil. Processing of a subsequent process becomes easy because curvature becomes small. Moreover, flux density goes up by making it a ferrite magnetism plate with thickness thicker than the conventional magnetic-substance thin film, and the property of a flat-surface mold magnetic-induction component improves by it. Moreover, a miniaturization can be attained by fixing a thin film coil directly to a semi-conductor substrate. Furthermore, much more miniaturization can be attained by carrying out the laminating of the thin film capacitor on a flat-surface mold magnetic-induction component.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] the conductor which the thin magnetic-substance thin film 54 is formed on the thin film coil 56, and forms this thin film coil 56 as the structure of the flat-surface mold magnetic-induction component carried in the conventional small power converter is shown in drawing 4 -- the clearance between between is filled up with the insulating filler (polyimide filler 55). Moreover, for a silicon substrate and 52, as for a lower insulator layer and 57, IC protective coat and 53 are [51 / an up insulator layer, the flat-surface mold magnetic-induction component of the former / 58 / 61 / a magnetic-substance thin film and /, and 62] protective coats by the number in drawing.
[0005] In this structure, by heat treatment, the magnetic-substance thin films 54 and 58 and the polyimide filler 55 will contract, and a semi-conductor substrate will curve for that stress. This curvature is produced by contraction of the magnetic-substance thin films 54 and 58 and the polyimide filler 55, that tensile stress is as large as 58xN/cm, and about 1200-micrometer curvature produces it in the silicon substrate 51 with a diameter [of 6 inches], and a thickness of 625 micrometers. Thus, if big curvature arises, processing of the photolithography of the up insulator layer 57 formed after that, the magnetic-substance thin film 58, and a protective coat 62 etc. will become difficult.
[0006] Moreover, although the magnetic-substance thin films 54 and 58 are formed by the spatter, since magnetic flux tends to be saturated since only about 10 micrometers can grow even if a growth rate is slow and thick, flux density is large and the engine performance of a flat-surface mold magnetic-induction component cannot take bad, it is necessary to enlarge occupancy area of the thin film coil 56. Furthermore, since a capacitor required as a small power converter is put side by side with the thin film coil 56 or a silicon substrate 51, a small power converter becomes large. The purpose of this invention solves the aforementioned technical problem, is micro, is highly efficient, and is to offer the power converter which curvature does not produce in a semi-conductor substrate.

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MEANS

[Means for Solving the Problem] In the micro power converter with which the passive component of a thin film was formed through the 1st insulator layer on the semiconductor integrated circuit equipment formed in the semi-conductor substrate in order to attain the aforementioned purpose On said semiconductor integrated circuit equipment, the flat-surface mold magnetic-induction component of a configuration of having inserted the thin film coil with the lower magnetic substance and the up magnetic substance is formed. Said lower magnetic substance formed in said semiconductor integrated circuit equipment side of this flat-surface mold magnetic-induction component is formed with a magnetic-substance thin film, and said up magnetic substance of said flat-surface mold magnetic-induction component considers as the configuration formed with magnetic-substance sheet metal.
[0008] When a thin film capacitor is formed on said magnetic-substance sheet metal, it is good because of a miniaturization. It can miniaturize, if the thin film coil of said flat-surface mold magnetic-induction component connects with said semiconductor integrated circuit equipment electrically through the contact hole which was able to be opened in said 1st insulator layer formed between said semiconductor integrated circuit equipment and said magnetic-substance thin films. If said magnetic-substance sheet metal is formed with a ferrite magnetism plate, the flux density in a FIRAITO magnetism plate will increase, the property of a flat-surface mold magnetic-induction component improves, the engine performance of a power converter improves, and there is effectiveness also in a miniaturization. Moreover, since curvature does not occur, processing becomes easy.
[0009] The conductor which forms the aforementioned thin film coil is good to be covered by the insulator. the conductor with which said insulator forms the 3rd insulator layer formed between said lower magnetic substance, the 2nd insulator layer by which it was formed between said thin film coils and said up magnetic substance, and a thin film coil, and said thin film coil -- if it consists of the 4th insulator layer with which the clearance between between was filled up, insulation will improve. This 4th insulator layer of being formed with polyimide is good. the conductor which forms said thin film coil -- if it has a clearance in between, it will much more be hard coming to generate the curvature of a semi-conductor substrate
[0010]
[Embodiment of the Invention] Drawing 1 is the micro power converter of the 1st example of this invention, this drawing (a) is an important section sectional view, and this drawing (b) is an explanatory view of the A section of this drawing (a). It is the polyimide film and SiO2 on the silicon substrate 1 which formed the DC-DC converter which accumulated IC for control, and the switching element as semiconductor integrated circuit equipment as shown in this drawing (b). The flat-surface mold magnetism induction component 11 is formed on the IC protective coats 2, such as film. IC for control which constitutes this DC-DC converter is formed by the CMOS circuit, and a switching element is for example, high proof-pressure p channel MOS FET for switching, and this drain is connected to a bonding pad 9. This flat-surface mold magnetism induction component 11 forms the magnetic-substance thin film 4 in one field of the thin film coil 6 through the lower insulator layers 3, such as polyimide film, (this magnetic-substance thin film 4 is surrounded by the lower insulator layer 3), and is having

structure which fixed the ferrite magnetism plate 8 which is magnetic-substance sheet metal through the up insulator layer 7 to the field of another side. The lower insulator layer 3 of the flat-surface mold magnetic-induction component 11 is formed on the IC protective coat 2 formed on the silicon substrate 1. In addition, the lower insulator layer 3 and the IC protective coat 2 of the flat-surface mold magnetic-induction component 11 which were manufactured according to the individual may be fixed. Moreover, the up insulator layer 7 and magnetic-substance sheet metal 8 fix after alignment by epoxy adhesion resin. the conductor of the thin film coil 6 -- in between, it fills up with the polyimide filler 5. The both ends of the thin film coil 6 open a contact hole 12 in the IC protective coat 2 and the lower insulator layer 3, and connect it with a silicon substrate 1 through this contact hole 12.

[0011] Thus, when the flux density in the ferrite magnetism plate 8 increases, the property of the flat-surface mold magnetic-induction component 11 improves by using the up insulator layer 7 and the magnetic substance which fixes as the ferrite magnetism plate 8 thicker than the conventional magnetic-substance thin film 58 and a DC-DC converter is manufactured now, the maximum conversion efficiency improves. Moreover, the miniaturization of the flat-surface mold magnetic-induction component 11 can be attained because flux density increases. Moreover, since it is hard coming to generate curvature in a silicon substrate 1, subsequent processing becomes easy. When the ferrite magnetism plate 8 of 300-micrometer thickness was used, specifically, curvature was mitigated about [conventional] to 2/3. Moreover, in order to fix the ferrite magnetism plate 8 by epoxy adhesion resin, a process is simplified rather than the case where the conventional magnetic-substance thin film 58 is formed by the spatter (reduction of a man day etc.). Moreover, by fixing the thin film coil 6 to the direct silicon substrate 1, it can miniaturize and, of course, dependability improves. Moreover, if the thickness of the ferrite magnetism plate 8 is 100 micrometers or more, the effectiveness of this invention will be acquired.

[0012] In addition, this drawing (b) shows a part of control circuit IC and the high proof pressure MOSFET for a switch which form a DC-DC converter. A control circuit IC shows n channel MOS FET and p channel MOS FET which constitute a complementary symmetry circuit, and n channel MOS FET is carrying out the duty with which p channel MOS FET slushes a current into the thin film coil 6, and the high proof pressure MOSFET for a switch draws out a current from the thin film coil 6. Moreover, the drain of the bonding pad 9 which the thin film coil 6 connects, p channel MOS FET, and n channel MOS FET is connected with the aluminum wiring 33. Moreover, the oxide film with which 31 in drawing consists of three layers, and 32 are the gate electrodes of MOSFET.

[0013] Drawing 2 is the important section sectional view of the micro power converter of the 2nd example of this invention. The difference from drawing 1 is the point of having lost the polyimide filler 5 filled up with the clearance between the conductors which form the thin film coil 6, and having covered the front face of the thin film coil 6 with the protective coats 13, such as an oxide film with a thickness of about 1 micrometer. This protective coat 13 is equivalent to the up insulator layer 7 of drawing 1 . The method of losing the polyimide filler 5 is good by skipping the process filled up with the polyimide filler after forming the thin film coil 6. Moreover, the oxide film which is this protective coat 13 may also form PVD, such as sputtering, by whichever of a CVD method. In addition, the part where the polyimide filler 5 exists by drawing 1 serves as a cavity, and this cavity is filled with air 14 etc.

[0014] Thus, since there is no polyimide filler 5, compared with the case of drawing 1 , it is much more hard coming to generate the curvature of a silicon substrate 1. Specifically, curvature was reduced about [conventional] to 1/5. Therefore, processing by the photolithography of the protective coat 13 after forming the thin film coil 6, the alignment at the time of attachment of the ferrite magnetism plate 8, etc. become easy. Other effectiveness is the same as the case of drawing 1 .

[0015] In addition, although not illustrated to the silicon substrate 1 of drawing 2 , of course to it, the DC-DC converter of drawing 1 (b) is formed. Drawing 3 is the important section sectional view of the micro power converter of the 2nd example of this invention. The difference from drawing 2 fixes what formed the thin film capacitor 20 through the insulator layer 17 on the ferrite magnetism plate 8 on an insulator layer 13. the electrode 16 of this thin film capacitor 20 -- Pt -- it is -- the ferroelectric thin film

15 -- PbZr1-x Tix O3 Or Pb(ScTa) O3 etc. -- it is formed with a ferroelectric ingredient. A thin film capacitor 20 is connected with a silicon substrate 1 by the wire bonding 10. In addition, of course, what formed the thin film capacitor 20 of drawing 3 in ferrite magnetism plate top 8 of drawing 1 through the insulator layer is not cared about, even if it fixes with the up insulator layer 7. If it is 100 micrometers or more as thickness of the ferrite magnetism plate 8, the effectiveness of this invention will be acquired.
[0016] Although the area of a small power converter was large in drawing 1 and drawing 2 since a capacitor was put side by side with a silicon substrate 1 on a silicon substrate 1 on the flat-surface mold magnetic-induction component 11, juxtaposition, or the circuit board The area of a silicon substrate 1 becomes small by carrying out a laminating on the flat-surface mold magnetic-induction component 11. Thus, in small power converters, such as a DC-DC converter The thin film capacitor 20 for smooth can be extended on 2 thru/or three pieces, and a silicon substrate 1, and the component-side products of a power converter can be reduced about [conventional] to 2/3.
[0017] In addition, although not illustrated to the silicon substrate 1 of drawing 3 , of course to it, the DC-DC converter of drawing 1 (b) is formed.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] With the micro power converter of the 1st example of this invention, (a) is an important section sectional view and (b) is the explanatory view of the A section of (a).
[Drawing 2] The important section sectional view of the micro power converter of the 2nd example of this invention
[Drawing 3] The important section sectional view of the micro power converter of the 3rd example of this invention
[Drawing 4] Structural drawing of a flat-surface mold magnetic-induction component carried in the conventional small power converter
[Description of Notations]
1 Silicon Substrate
2 IC Protective Coat
3 Lower Insulator Layer
4 Magnetic-Substance Thin Film
5 Polyimide Filler
6 Thin Film Coil
7 Up Insulator Layer
8 Ferrite Magnetism Plate
9 Ten Bonding wire
11 Flat-Surface Mold Magnetic-Induction Component
12 Contact Hole
13 Protective Coat
14 Air
15 Ferroelectric Thin Film
16 Electrode
17 Insulator Layer
20 Thin Film Capacitor

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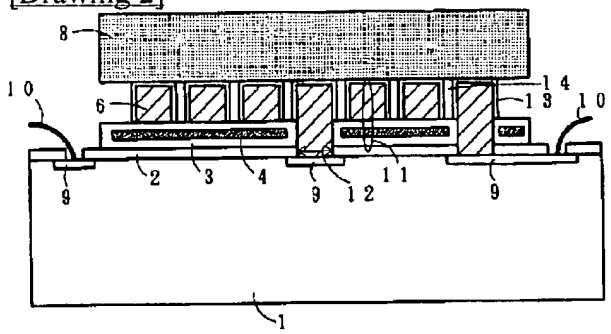
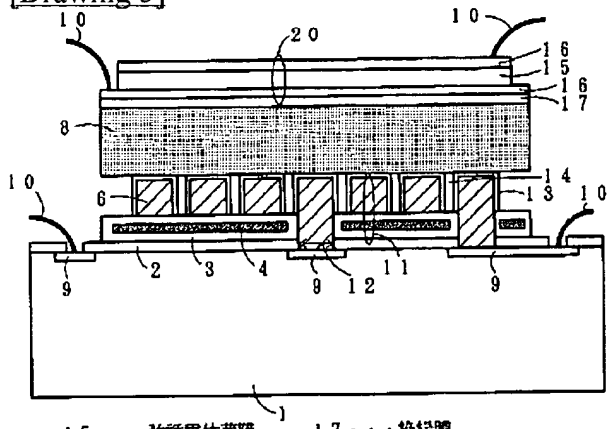
DRAWINGS

[Drawing 2]



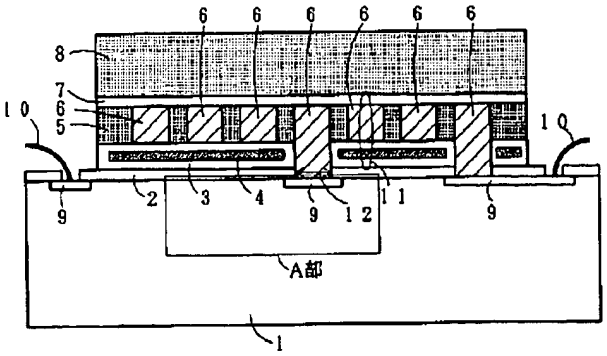
13・・・保護膜
14・・・空気

[Drawing 3]



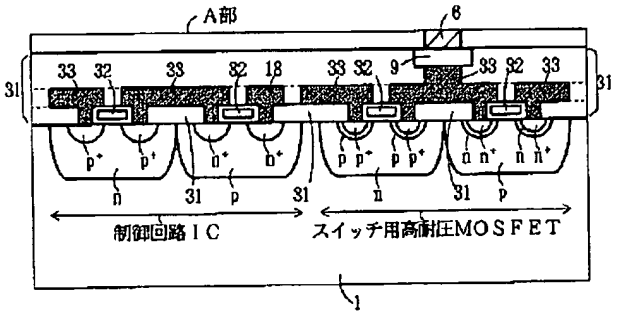
15・・・強誘電体薄膜　17・・・絶縁膜
16・・・電極　20・・・薄膜コンデンサ

[Drawing 1]



1・・・シリコン基板
2・・・IC保護膜
3・・・下部絶縁膜
4・・・磁性体薄膜
5・・・ポリイミド充填材
6・・・薄膜コイル
7・・・上部絶縁膜
8・・・フェライト磁性板
9・・・ボンディングパッド
10・・・ボンディングワイヤ
11・・・平面型磁気誘導素子
12・・・コンタクトホール

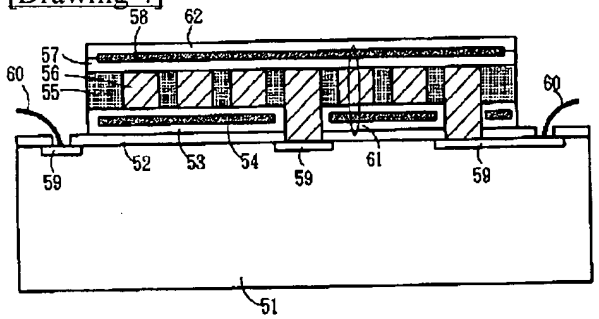
(a)



31・・・酸化膜
32・・・ゲート電極
33・・・AI配線

(b)

[Drawing 4]



52・・・IC保護膜
53・・・下部絶縁膜
54・・・磁性体薄膜
55・・・ポリイミド充填材
56・・・薄膜コイル
57・・・上部絶縁膜
59・・・ボンディングパッド
60・・・ボンディングワイヤ
61・・・平面型磁気誘導素子
62・・・保護膜

[Translation done.]